Hyperon Physics at BESIII

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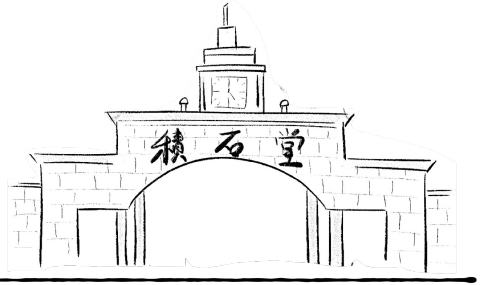
On behalf of BESIII collaboration

22nd Lomonosov Conference on Elementary Particle Physics

August, 21-27, 2025, Moscow State University

Outline

- Introduction
- Hyperon polarization & CPV
- Hyperon pair production
- Hyperon nucleon interaction
- Conclusion & Outlook



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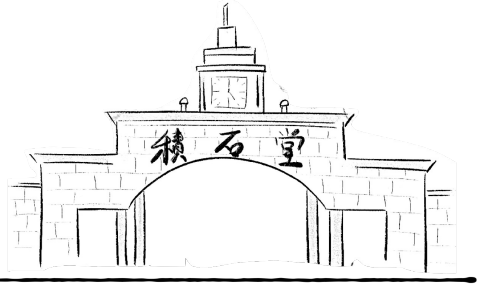
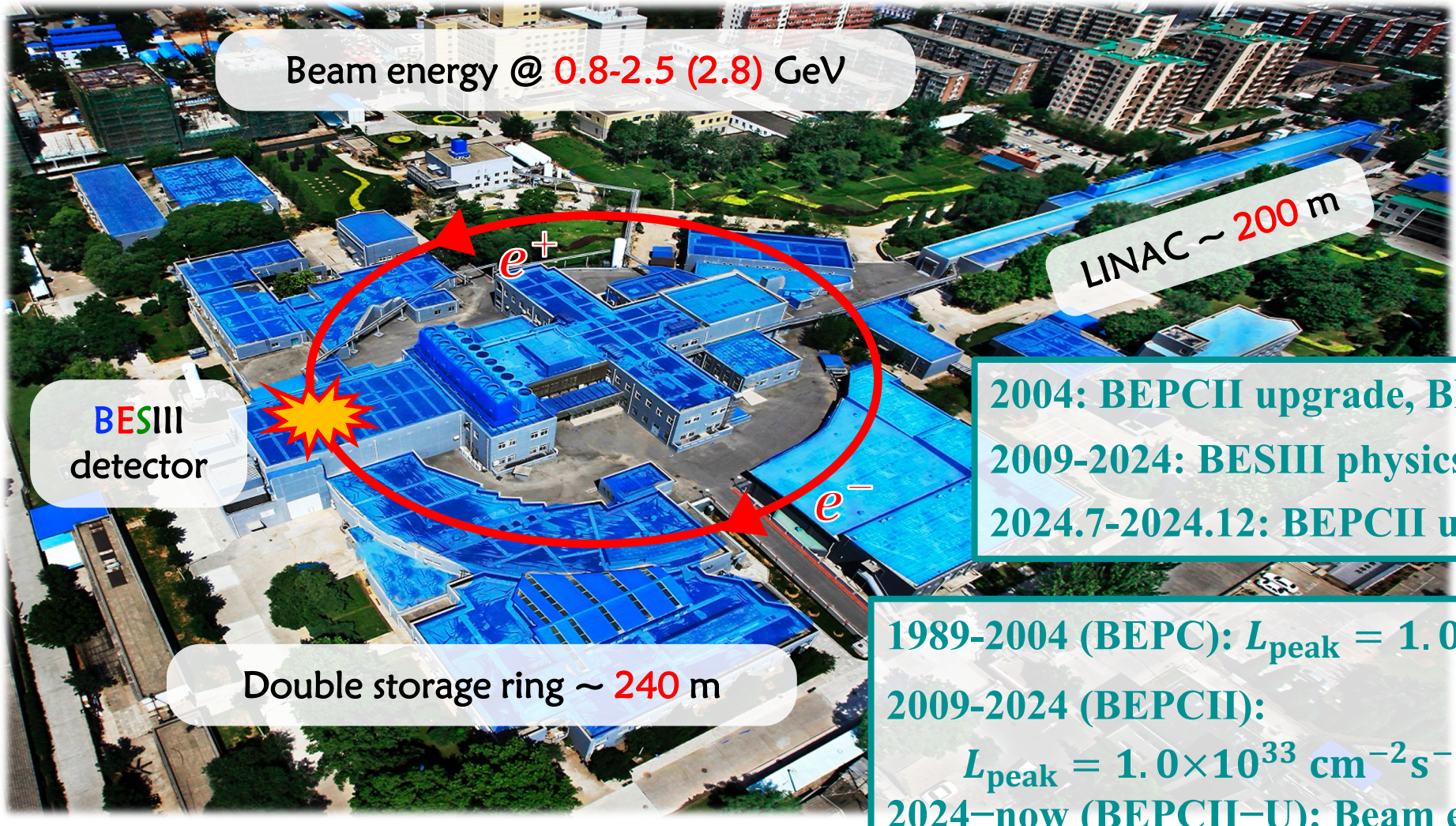


BEPCII and BESIII Detector



2004: BEPCII upgrade, BESIII construction

2009-2024: BESIII physics and SR run

2024.7-2024.12: BEPCII upgrade to BEPCII-U

1989-2004 (BEPC): $L_{peak} = 1.0\times10^{31}$ cm^{-2}s^{-1}

2009-2024 (BEPCII):

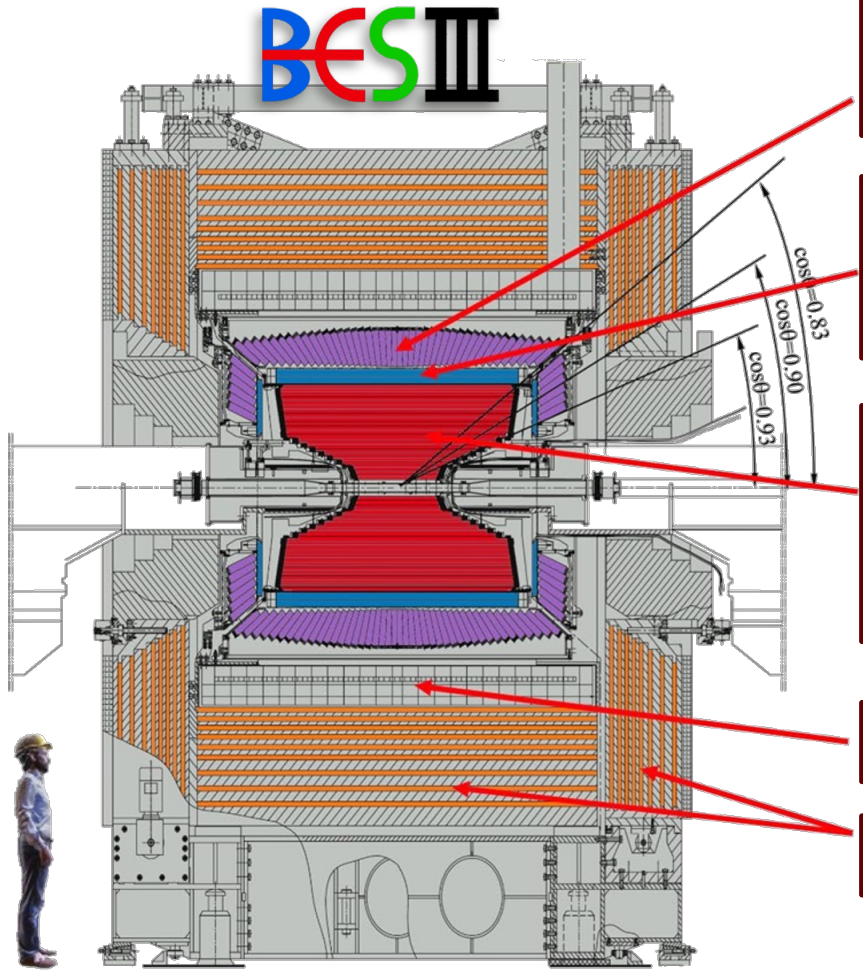
$L_{peak} = 1.0\times10^{33}$ cm^{-2}s^{-1} (beyond the design)

2024–now (BEPCII–U): Beam energy up to 2.8 GeV

BEPCII and BESIII Detector

- ✓ 10 billion J/ψ events
- ✓ 2.7 billion (more) $\psi(2S)$ events
- ✓ 20 fb^{-1} $\psi(3770)$ samples
- ✓ ~30 fb^{-1} R-scan & XYZ samples

- ✓ High statistic of data
- ✓ Clean background environment
- ✓ Angular coverage is almost 4π sr
- ✓ Wider energy range



EMC: CsI crystals
$\Delta E/E = 2.5\%$ @ 1 GeV (Barrel)
$\Delta E/E = 5.0\%$ @ 1 GeV (Endcap)

TOF:
$\sigma_T = 80$ ps (Barrel)
$\sigma_T = 110$ (60) ps (Endcap)

MDC: small cell & filled with helium
$\sigma_{xy} = 130$ μm
$\sigma_p/p = 0.5\%$ @ 1 GeV
$dE/dx = 6\%$

Super Conducting Magnet: 1 T

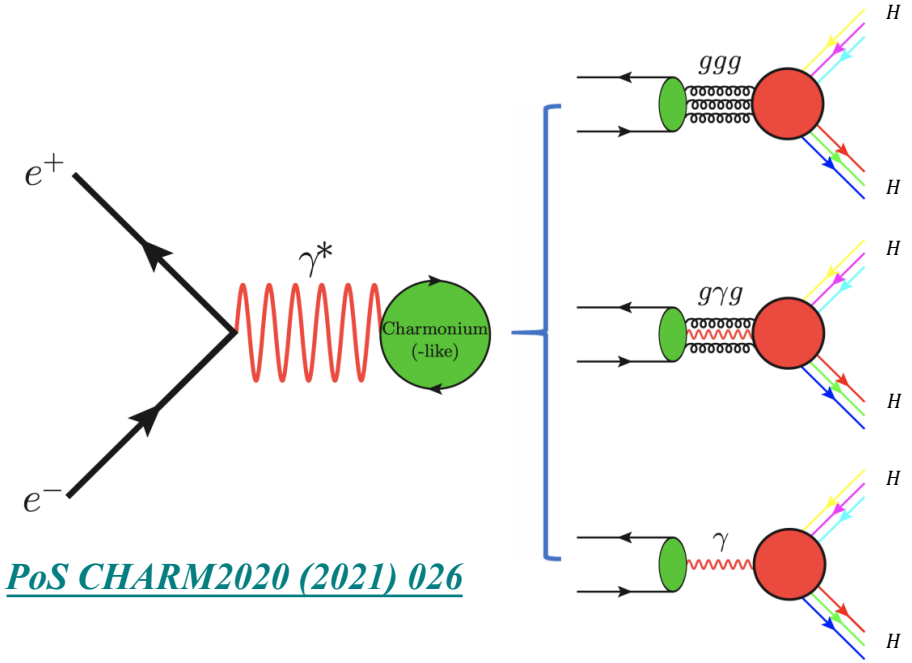
Muon ID: 9 layers RPC

Operating since 2008

Hadron structure & dynamics in the non-perturbative QCD regime.

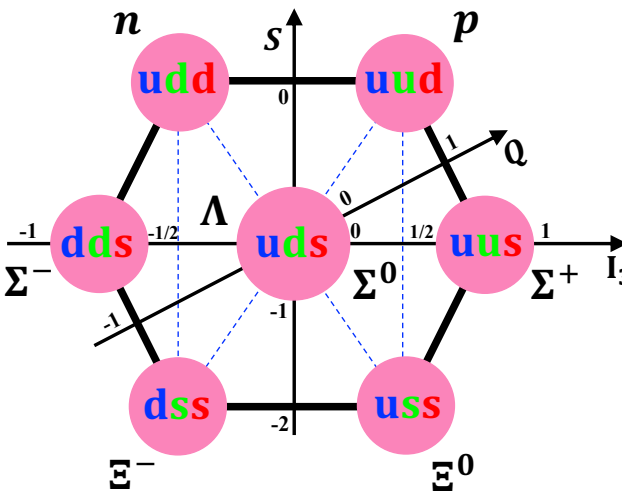
A New Avenue

- **A hyperon factory, provide a rich laboratory for probing non-pQCD, hyperon property/CPV, pQCD, etc.**

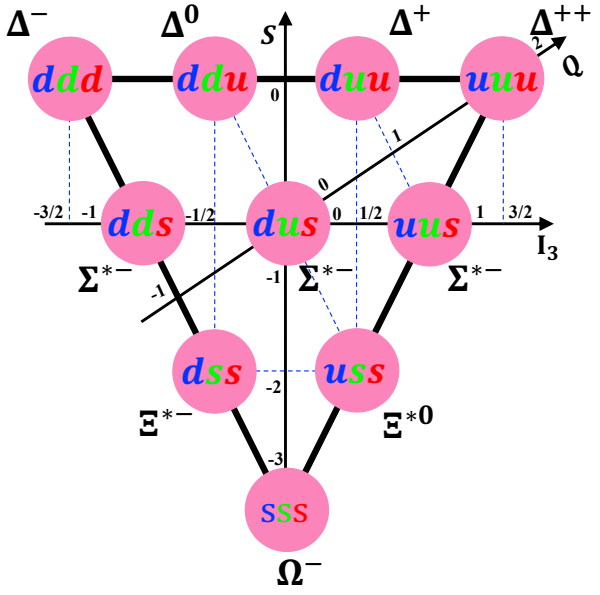


PoS CHARM2020 (2021) 026

$H\bar{H}$ pair production



Baryon Octuplet



Baryon Decuplet

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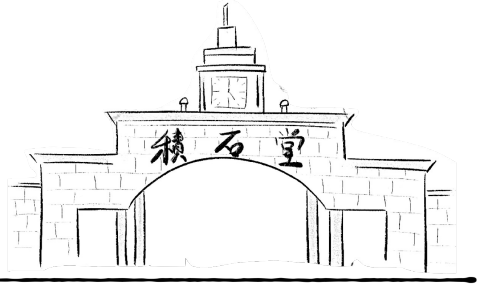
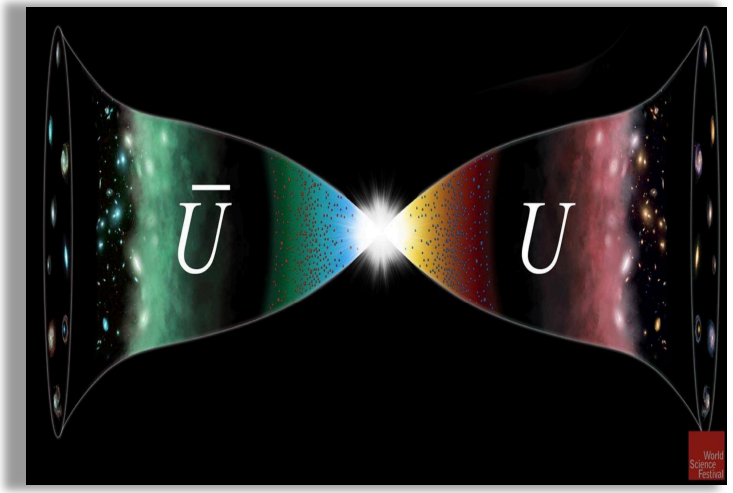
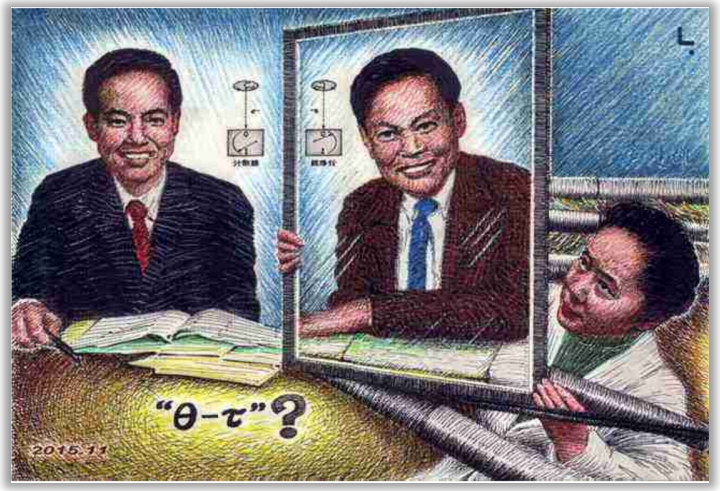
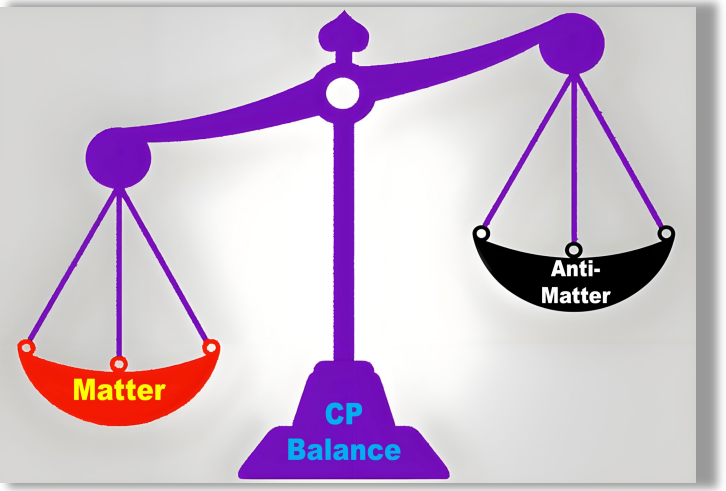


Matter-antimatter asymmetry

- One of the greatest mysteries of modern physics is to figure out why there is so much more matter than antimatter in the Universe





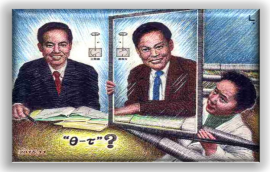


Sakharov three conditions:

1. Baryon number B violation
2. C and CP symmetry violation
3. Interactions out of thermal equilibrium

The CPV in collider experiment could be top priority for this big question

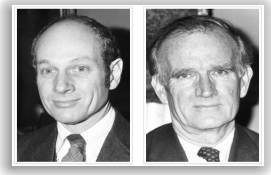
History of CPV



PR**104** 254, PR**105** 1413

Parity Violation
in weak decay
T.D. Lee and C.N. Yang
C. S. Wu *et al.*

1957



PRL**133** 138

CP Violation
in *K* meson decay
J.W. Cronin and
V.L. Fitch *et al.*

1964

PRL**87** 091801
PRL**87** 091802

CP Violation
in B^0meson decay
[*BABAR*] and [Belle]

2001

PRL**122** 211803

CP Violation
in D^0meson decay
[LHCb]

2019

Nature**133** 138

CP Violation
in Λ_b^0baryon decay
[LHCb]

2025

New!

1963

Cabibbo Mixing
N. Cabibbo

PRL**133** 138

1973

CKM Matrix
M. Kobayashi and
T. Maskawa

PTP**49** 652

2013

CP Violation
in B_s^0meson decay
[LHCb]

PRL**110** 221601

2020

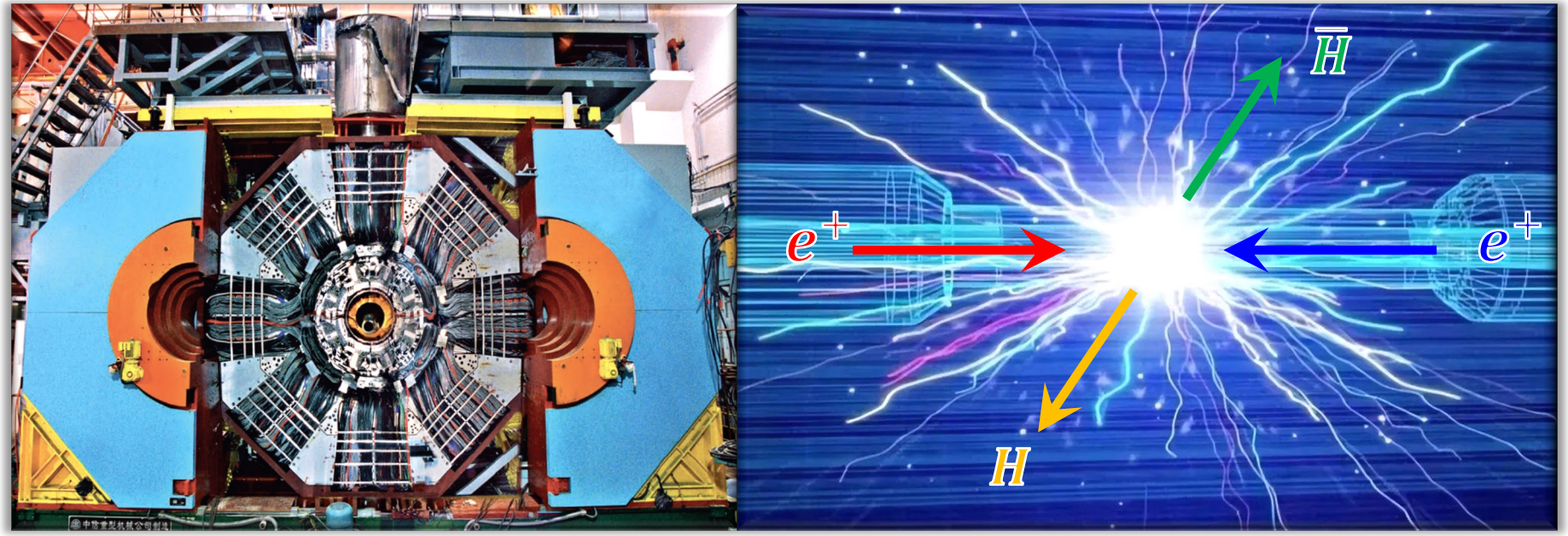
CP Violation
in neutrino oscillation
[T2T]

Nature**580** 339

Year

Symmetry 15 (2023) 214

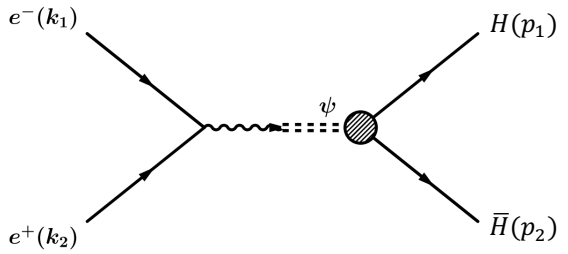
Why hyperon CPV at BESIII



- World's largest charmonium data samples: 10B J/ψ and 3B $\psi(3686)$
- Large BR for hyperon pair production in J/ψ and $\psi(3686)$
- Quantum entangled pair production
- Clean background, etc.

Hyperon polarization and CPV

Non-zero ΔΦ: Transverse polarization

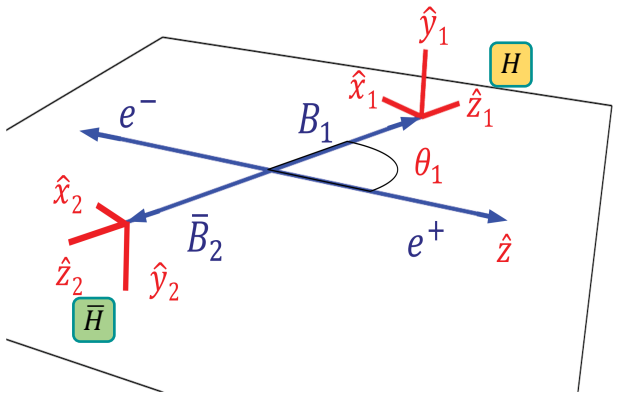


$$\Gamma^e_\mu(k_1,k_2) = -ie_\psi \gamma_\mu$$

$$\Gamma_\mu(p_1,p_2) = -ie_g\left[G_M^\psi \gamma_\mu - \frac{2M}{Q^2}(G_M^\psi - G_E^\psi)Q_\mu\right]$$

$$\alpha_\psi = \frac{s\left|G_M^\psi\right|^2 - 4M^2\left|G_E^\psi\right|^2}{s\left|G_M^\psi\right|^2 + 4M^2\left|G_E^\psi\right|^2}$$

$$\frac{G_E^\psi}{G_M^\psi} = e^{i\Delta\Phi}\left|\frac{G_E^\psi}{G_M^\psi}\right|$$



$$\rho_{B_1,\bar{B}_2} = \frac{1}{4}\sum_{\mu,\bar{\nu}=0}^{3} C_{\mu\bar{\nu}}(\theta_1)\sigma_\mu^{B_1} \otimes \sigma_{\bar{\nu}}^{\bar{B}_2}$$

$$C_{\mu\bar{\nu}} = (1+\alpha_\psi\cos^2\theta_\Xi)\begin{pmatrix} 1 & 0 & P_y & 0 \\ 0 & C_{xx} & 0 & C_{xz} \\ -P_y & 0 & C_{yy} & 0 \\ 0 & -C_{xz} & 0 & C_{zz} \end{pmatrix}$$

ΔΦ

$$P_y(\cos\theta) = \frac{\sqrt{1-\alpha_\psi^2}\sin(\Delta\Phi)\cos\theta\sin\theta}{1+\alpha_\psi\cos^2\theta}$$

[PLB 772 (2017) 16–20]
[PRD 99, 056008 (2019)]

Construct CPV observables

Amplitude of hyperon decay

$$\mathcal{A} = \mathcal{S} + \mathcal{P}\boldsymbol{\sigma}\cdot\hat{\boldsymbol{n}} \Rightarrow \begin{aligned}\mathcal{S} &= |\mathcal{S}|e^{i(\delta_\mathcal{S}+\xi_\mathcal{S})} \\ \mathcal{P} &= |\mathcal{P}|e^{i(\delta_\mathcal{P}+\xi_\mathcal{P})}\end{aligned}$$

Lee-Yang parameters

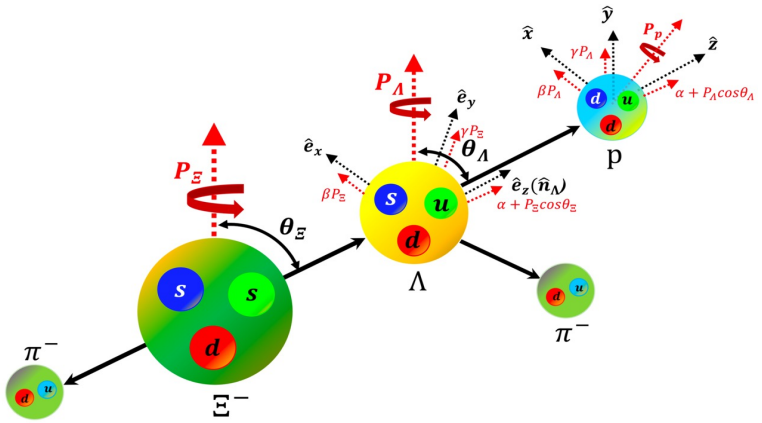
[Phys. Rev. 108 1645 (1957)]

$$\begin{cases}\alpha_\Xi = \dfrac{2Re(\mathcal{S}^*\mathcal{P})}{|\mathcal{S}|^2+|\mathcal{P}|^2} \\ \beta_\Xi = \dfrac{2Im(\mathcal{S}^*\mathcal{P})}{|\mathcal{S}|^2+|\mathcal{P}|^2} \\ \gamma_\Xi = \dfrac{|\mathcal{S}|^2-|\mathcal{P}|^2}{|\mathcal{S}|^2+|\mathcal{P}|^2}\end{cases} \quad \begin{cases}\alpha_\Xi^2+\beta_\Xi^2+\gamma_\Xi^2 = 1 \\ \beta_\Xi = \sqrt{1-\alpha_\Xi^2}\sin\phi_\Xi \\ \gamma_\Xi = \sqrt{1-\alpha_\Xi^2}\cos\phi_\Xi \\ \phi_\Xi = \tan^{-1}(\dfrac{\beta_\Xi}{\gamma_\Xi})\end{cases}$$

Then, one can construct CPV observables:

$$\begin{cases}A_{CP}^\Xi = \dfrac{\alpha_\Xi+\alpha_\Xi}{\alpha_\Xi-\alpha_\Xi} \\ B_{CP}^\Xi = \dfrac{\beta_\Xi+\beta_\Xi}{\beta_\Xi-\beta_\Xi} \\ C_{CP}^\Xi = \dfrac{\gamma_\Xi+\gamma_\Xi}{\gamma_\Xi-\gamma_\Xi}\end{cases} \quad \begin{cases}\Delta\phi_{CP}^\Xi = \dfrac{\phi_\Xi+\phi_\Xi}{2} \\ \delta_P-\delta_S \approx \arctan\left(\dfrac{\beta_\Xi}{\alpha_\Xi}\right) \\ \xi_P-\xi_S \approx \arctan\left(\dfrac{\beta_\Xi+\beta_\Xi}{\alpha_\Xi-\alpha_\Xi}\right)\end{cases}$$

$e^+e^- \to J/\psi \to \Xi^-\bar{\Xi}^+$



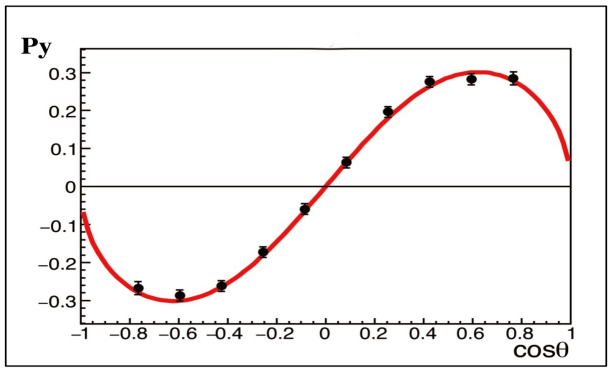
$$\mathcal{W} = \sum_{\mu,\bar{\mu}=0}^{3} C_{\mu\bar{\mu}} \sum_{\nu=0}^{3}\sum_{\bar{\nu}=0}^{3} a^{\Xi}_{\mu\nu} a^{\Lambda}_{\nu 0} a^{\bar{\Xi}}_{\bar{\mu}\bar{\nu}} a^{\bar{\Lambda}}_{\bar{\nu}0}$$

hyperon side: $1^{--} \to \frac{1}{2}^+\frac{1}{2}^-$ ($J/\psi \to \Xi^-\bar{\Xi}^+$); $\frac{1}{2}^+ \to \frac{1}{2}^+ 0^-$ ($\Xi^- \to \Lambda\pi^-$)

Anti-hyperon side: $\frac{1}{2}^+ \to \frac{1}{2}^+ 0^-$ ($\bar{\Lambda} \to \bar{p}\pi^+$)

$\boldsymbol{\xi} = (\theta_{Y_1}, \theta_{Y_2}, \varphi_{Y_2}, \bar{\theta}_{Y_2}, \bar{\varphi}_{Y_2}, \theta_B, \varphi_B, \bar{\theta}_B, \bar{\varphi}_B)$ - set of helicity angles

$\boldsymbol{\omega} = (\alpha_\psi, \Delta\Phi, \alpha_{Y_1}, \phi_{Y_1}, \bar{\alpha}_{Y_1}, \bar{\phi}_{Y_1}, \alpha_{Y_2}, \bar{\alpha}_{Y_2})$ - set of measured parameters



Data Sample: 1.3 B J/ψ ~73,000

Nature 606, 64 (2022)

Table 1 | Summary of results

Parameter	This work	Previous result
α_ψ	0.586±0.012±0.010	0.58±0.04±0.08
$\Delta\Phi$	1.213±0.046±0.016 rad	–
α_Ξ	−0.376±0.007±0.003	−0.401±0.010
ϕ_Ξ	0.011±0.019±0.009 rad	−0.037±0.014 rad
$\bar{\alpha}_\Xi$	0.371±0.007±0.002	–
$\bar{\phi}_\Xi$	−0.021±0.019±0.007 rad	–
α_Λ	0.757±0.011±0.008	0.750±0.009±0.004
$\bar{\alpha}_\Lambda$	−0.763±0.011±0.007	−0.758±0.010±0.007
$\xi_P - \xi_S$	$(1.2\pm3.4\pm0.8)\times10^{-2}$ rad	–
$\delta_P - \delta_S$	$(-4.0\pm3.3\pm1.7)\times10^{-2}$ rad	$(10.2\pm3.9)\times10^{-2}$ rad
A_{CP}^{Ξ}	$(6\pm13\pm6)\times10^{-3}$	–
$\Delta\phi_{CP}^{\Xi}$	$(-5\pm14\pm3)\times10^{-3}$ rad	–
A_{CP}^{Λ}	$(-4\pm12\pm9)\times10^{-3}$	$(-6\pm12\pm7)\times10^{-3}$
$\langle\phi_\Xi\rangle$	0.016±0.014±0.007 rad	

Non-zero phase: Ξ^- spin polariztion

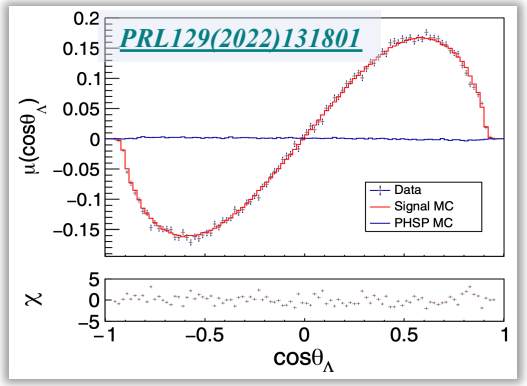
First measurement: $\bar{\alpha}_\Xi, \bar{\phi}_\Xi, \xi_P - \xi_S, A_{CP}^{\Xi}, \Delta\phi_{CP}^{\Xi}$

Strong/ weak phase difference

Three CP observables

- **Observation of Ξ^- spin polariztion, non-zero weak phase difference**
- **Most precise test for CPV in strange hyperon decay**
- **Update with 10 billion J/ψ is ongoing**

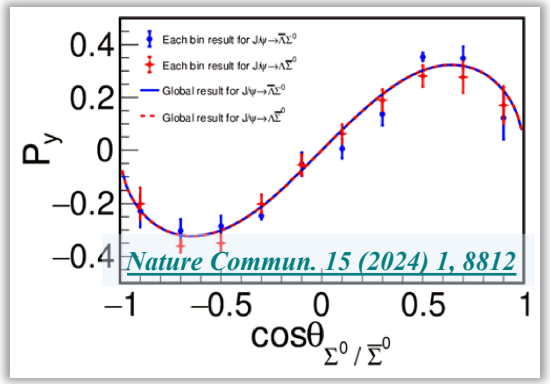
More experimental advances



$J/\psi \to \Lambda\bar{\Lambda} \to p\pi^-\bar{p}\pi^+$

$\Delta\Phi = (43.1 \pm 0.2 \pm 0.4)°$

$A_{CP} = (-2.5 \pm 4.6 \pm 1.2)\times10^{-3}$

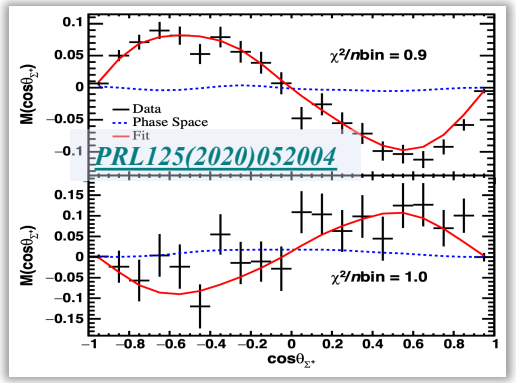


$J/\psi \to \Lambda\bar{\Sigma}^0 + c.c.$

$\Delta\Phi_1 = (58.9 \pm 5.5 \pm 0.6)°$

$\Delta\Phi_2 = (124.0 \pm 5.5 \pm 0.6)°$

$\Delta\Phi_{CP} = |\pi - (\Delta\Phi_1 + \Delta\Phi_2)| \sim 0$

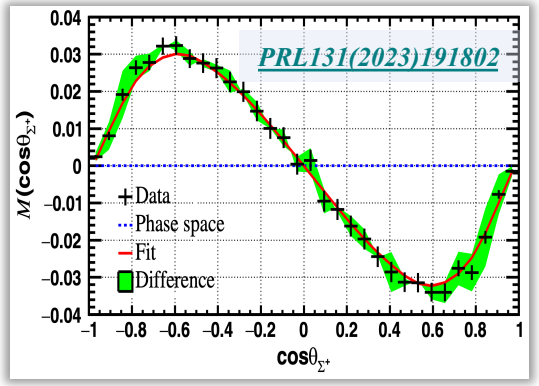


$\psi \to \Sigma^+\bar{\Sigma}^- \to p\pi^0\bar{p}\pi^0$

$\Delta\Phi_{J/\psi} = (-15.5 \pm 0.7 \pm 0.5)°$

$\Delta\Phi_{\psi(3686)} = (21.7 \pm 4.0 \pm 0.8)°$

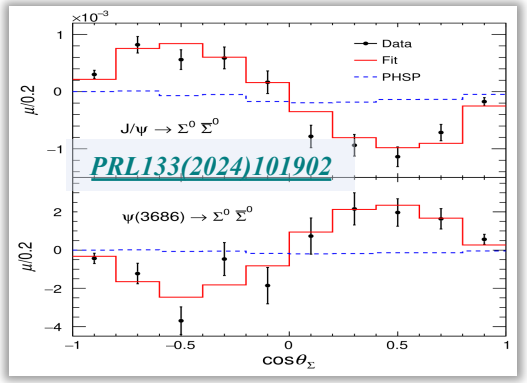
$A_{CP} = (-0.4 \pm 3.7 \pm 1.0)\times10^{-2}$



$J/\psi \to \Sigma^+\bar{\Sigma}^- \to n\pi^+\bar{p}\pi^0$

$\Delta\Phi = (-16.1 \pm 0.3 \pm 0.3)°$

$A_{CP} = (-8.0 \pm 5.2 \pm 2.8)\times10^{-2}$



$\psi \to \Sigma^0\bar{\Sigma}^0 \to \gamma\gamma\Lambda\bar{\Lambda}$

$\Delta\Phi_{J/\psi} = (-15.5 \pm 0.7 \pm 0.5)°$

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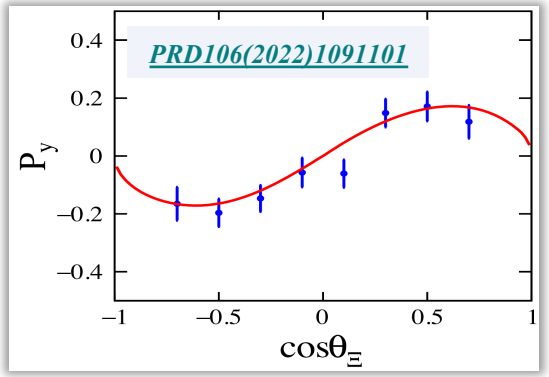
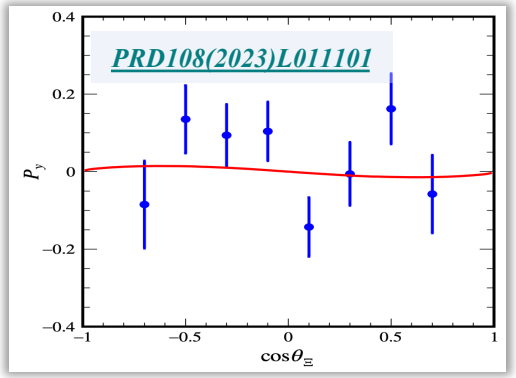


$\psi(3686) \to \Xi^-\bar{\Xi}^+ \to \pi^-\pi^+\Lambda\bar{\Lambda}$

$\Delta\Phi = (39 \pm 6 \pm 3)°$

$A_{CP} = (-2 \pm 5 \pm 1)\times10^{-2}$

$\Delta\phi_{CP}^{\Xi} = (-5 \pm 5 \pm 1)\times10^{-2}$

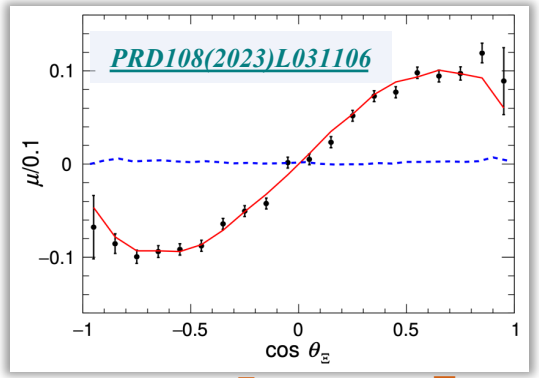


$\psi(3686) \to \Xi^0\bar{\Xi}^0 \to \pi^0\pi^0\Lambda\bar{\Lambda}$

$\Delta\Phi = (3 \pm 9 \pm 1)°$

$A_{CP} = (-0.7 \pm 8.2 \pm 2.5)\times10^{-2}$

$\Delta\phi_{CP}^{\Xi} = (-7.9 \pm 8.2 \pm 1.0)\times10^{-2}$



$J/\psi \to \Xi^0\bar{\Xi}^0 \to \pi^0\pi^0\Lambda\bar{\Lambda}$

$\Delta\Phi = (68 \pm 1 \pm 1)°$

$A_{CP} = (-5.4 \pm 6.5 \pm 3.1)\times10^{-3}$

$\Delta\phi_{CP}^{\Xi} = (-0.1 \pm 6.9 \pm 0.9)\times10^{-3}$

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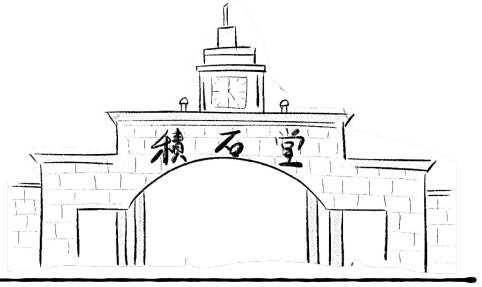
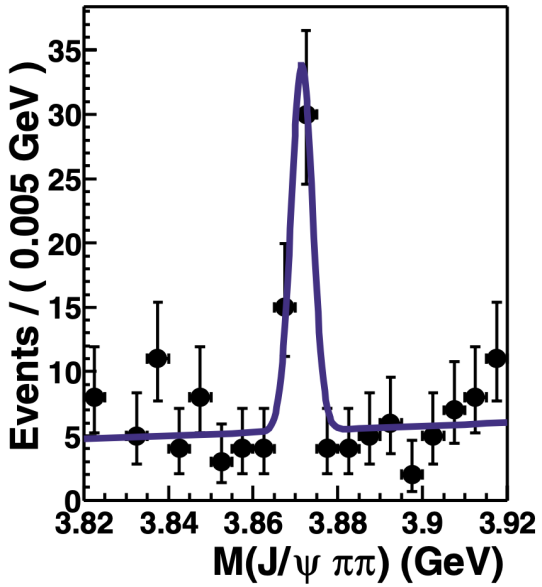


XYZ/Charmonium (-like) state

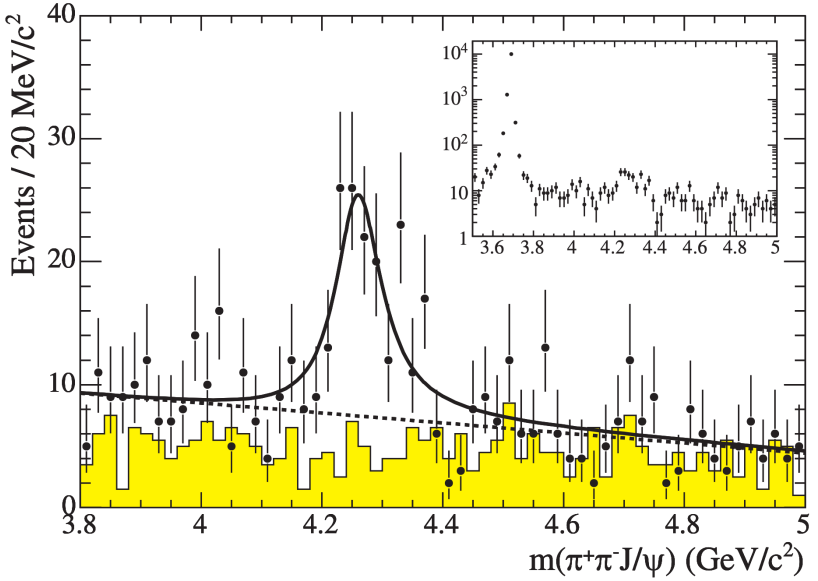
- A series of XYZ states have been observed in past decades.

$X(3872)$



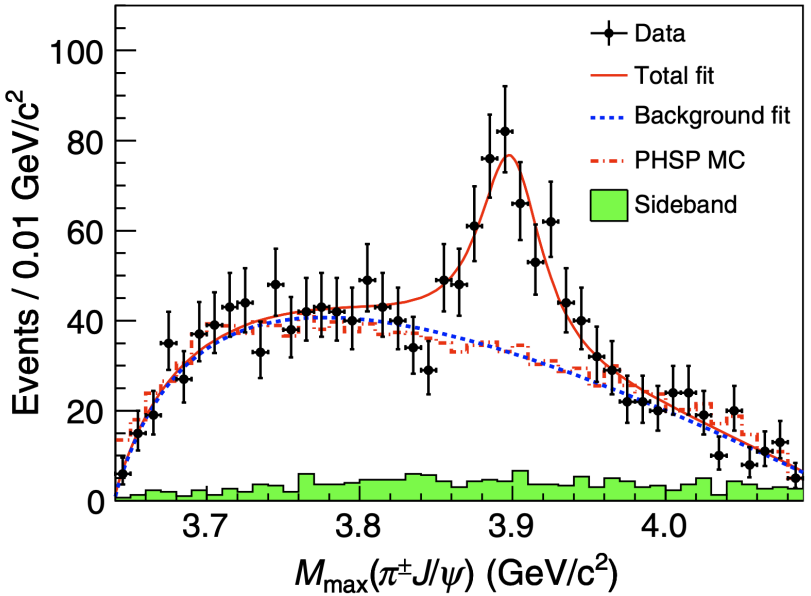
Phys. Rev. Lett. 91, 262001(2003)

$Y(4260)$



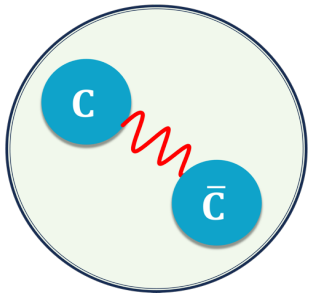
Phys. Rev. Lett. 95, 142001(2005)

$Z_c(3900)$

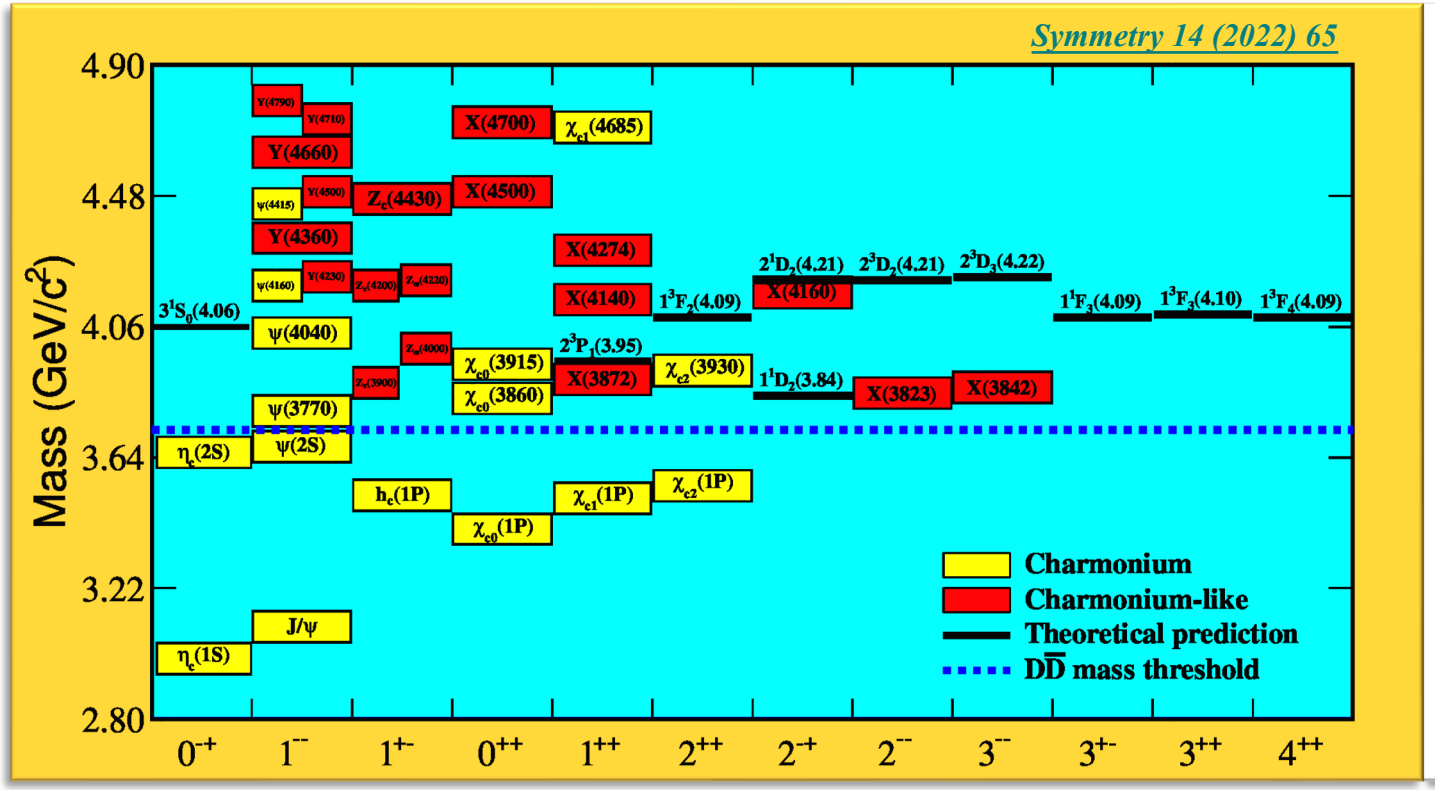


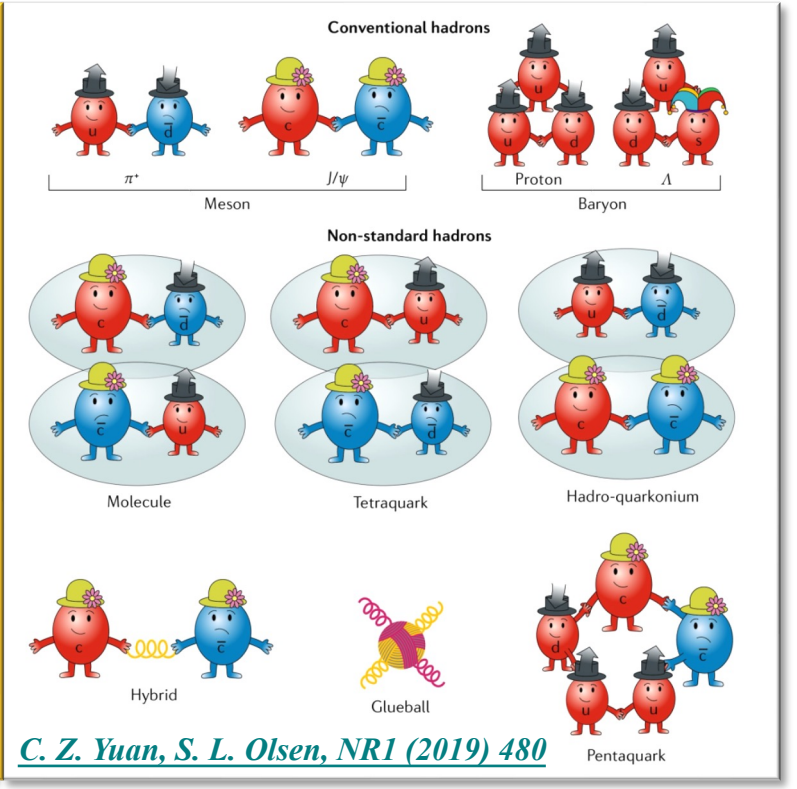
Phys. Rev. Lett. 110, 252001(2013)

XYZ/Charmonium (-like) state



- **Conventional Charmonium states**: Nonrelativistic $c\bar{c}$ bound state.
- **XYZ/Charmonium-like states**: Various scenarios have been proposed.





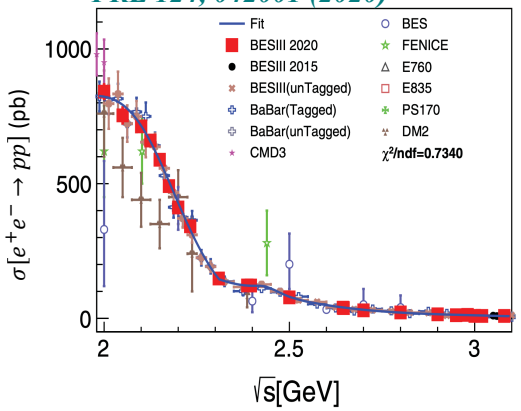
- **Nature still needs more effort in theory and experiment.**

$e^+e^- \to H\bar{H}$ near threshold

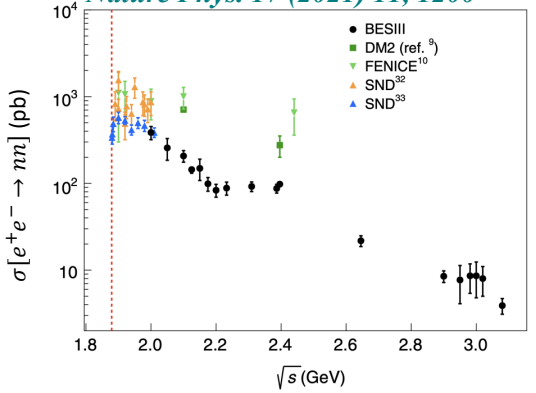
- **Threshold enhancement**

$e^+e^- \to p\bar{p}/n\bar{n}/\Lambda\bar{\Lambda}/\Lambda\bar{\Sigma}^0$

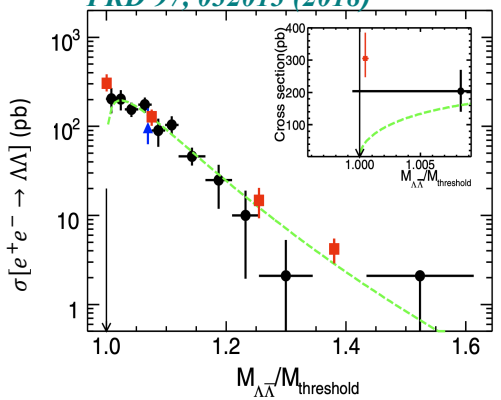
PRL 124, 042001 (2020)



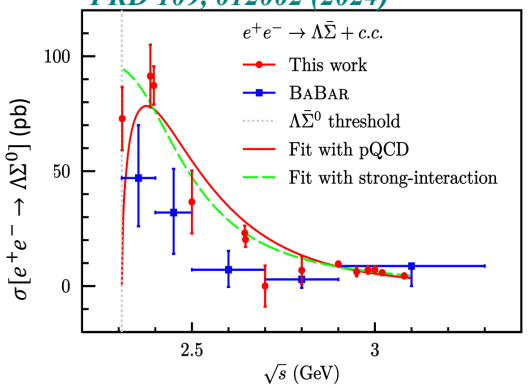
Nature Phys. 17 (2021) 11, 1200

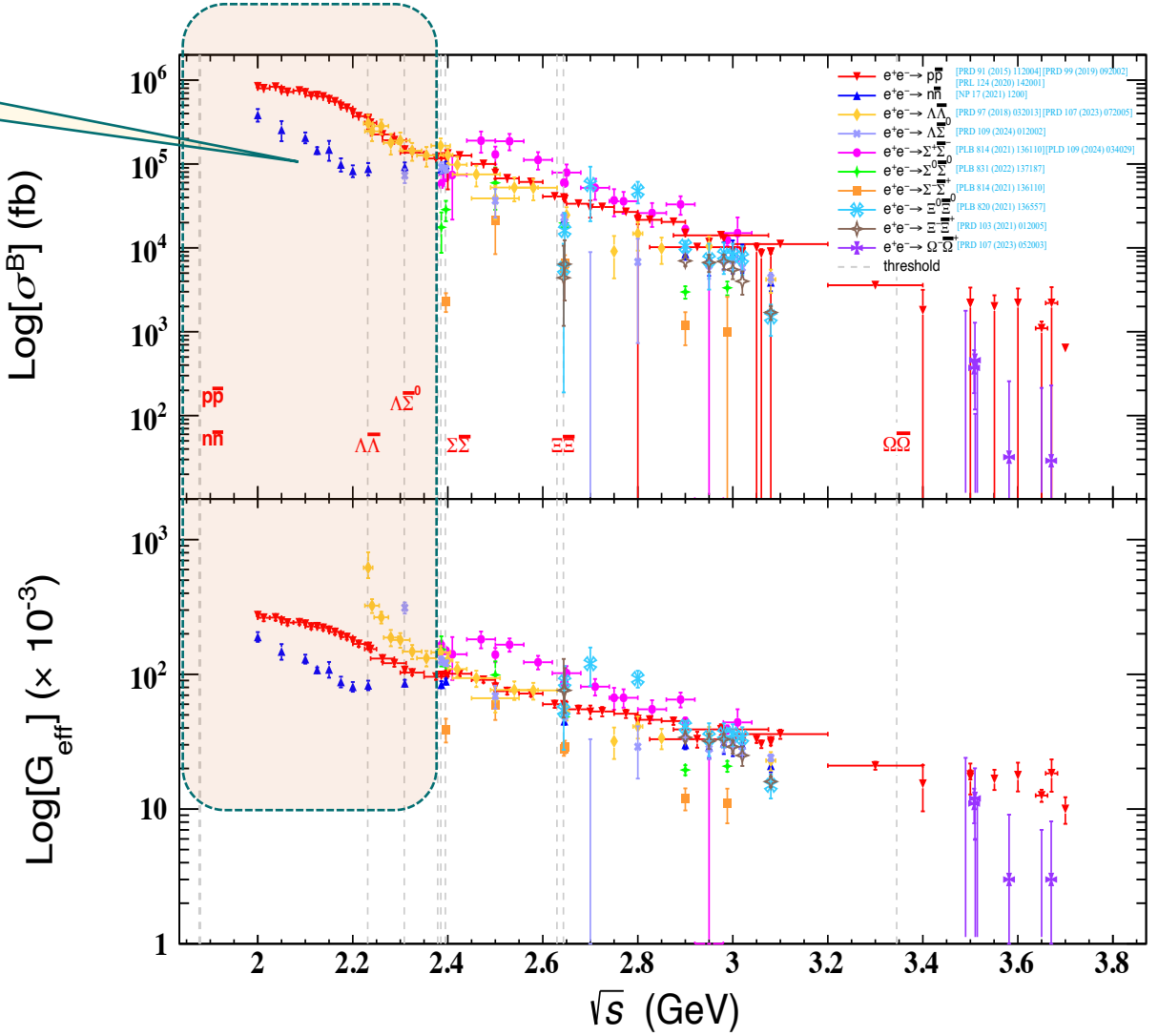


PRD 97, 032013 (2018)

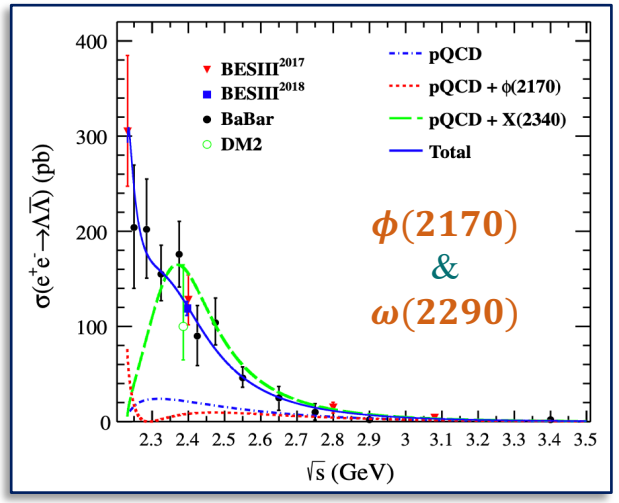


PRD 109, 012002 (2024)

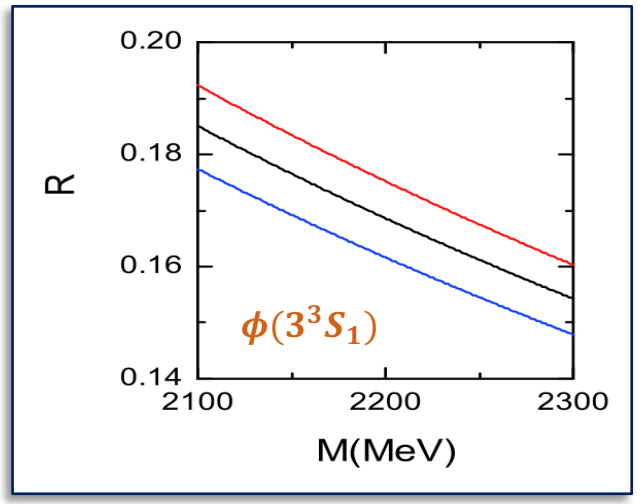




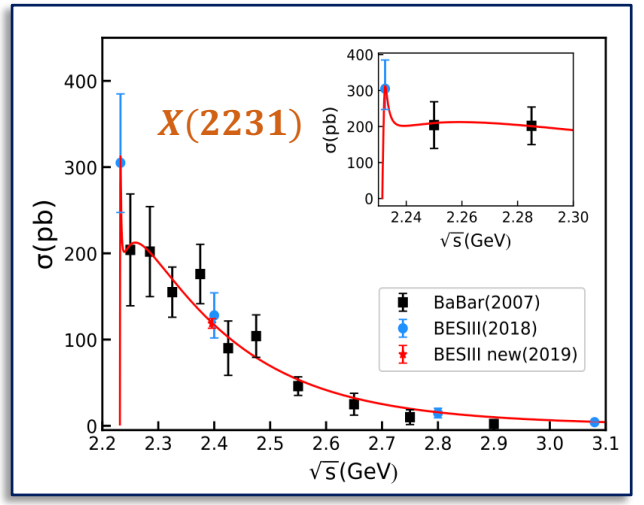
Diverse theoretical explanations



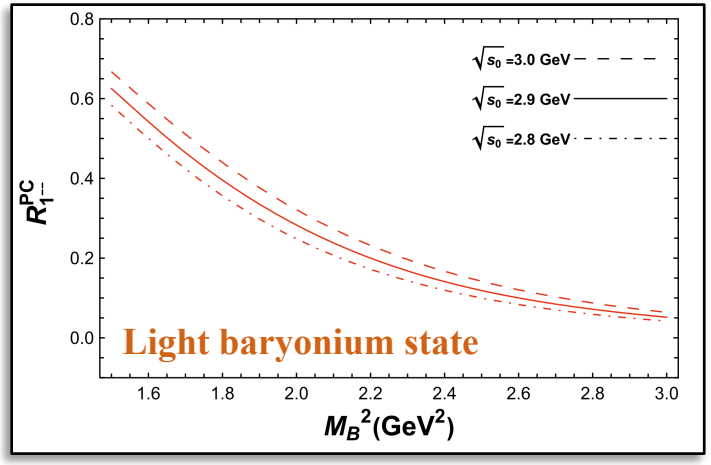
Cao et al, PRD 98, 094006 (2018)



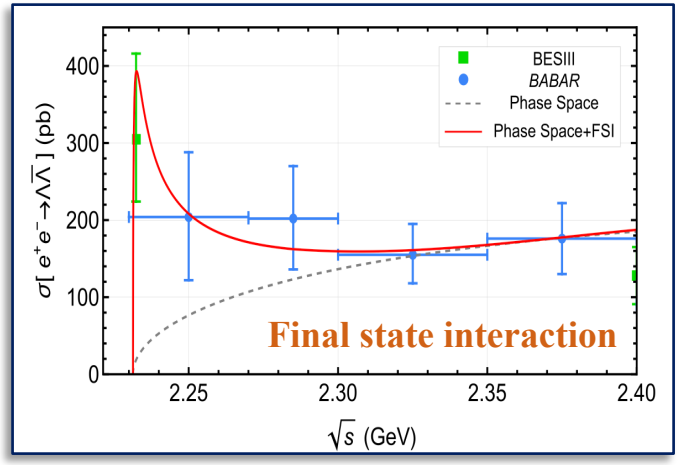
Xiao et al, CPC 43, 113105 (2019)



Xie et al, CPL 39, 011201 (2022)



Wan et al, PRD 105, 014016 (2022)



Qian et al, PRD 107, L091502 (2023)

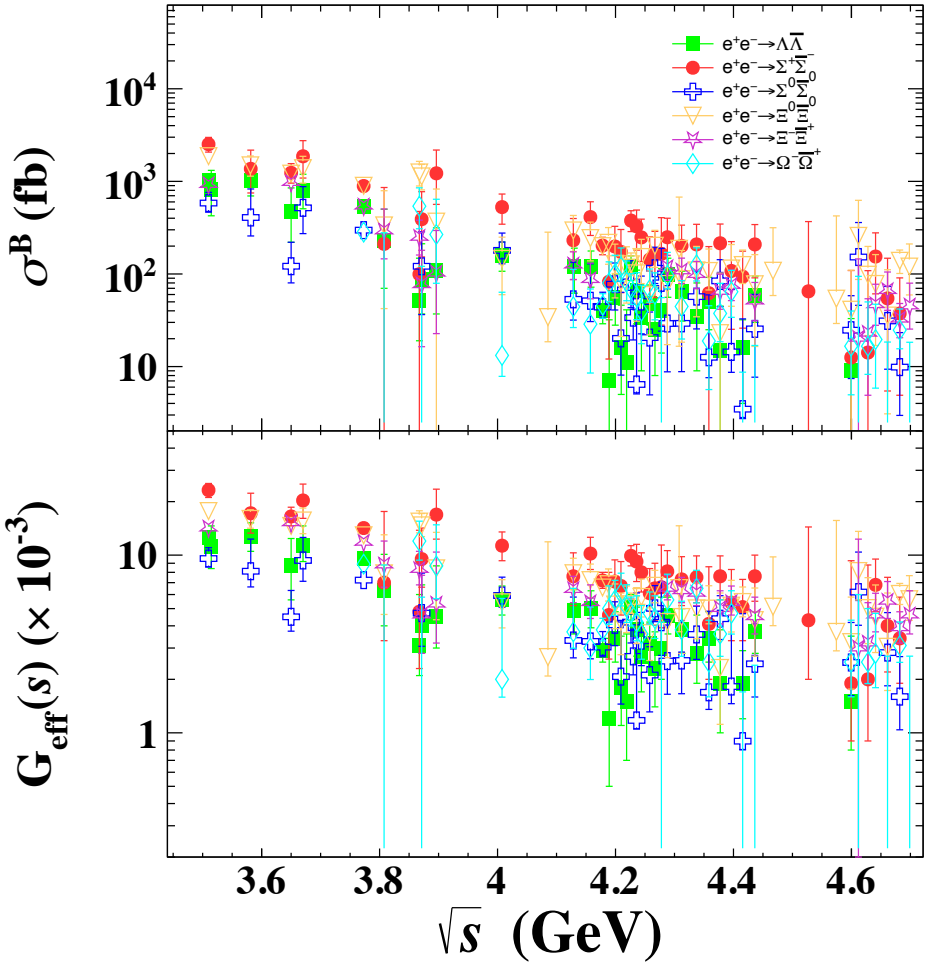
Physics behind it has not yet been well established

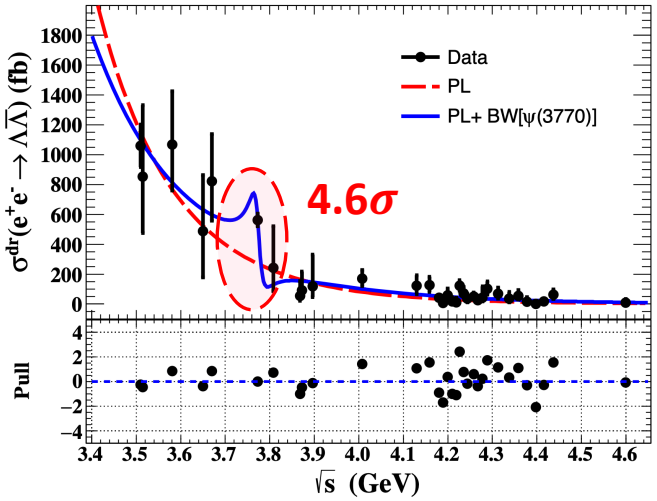
Need more effort

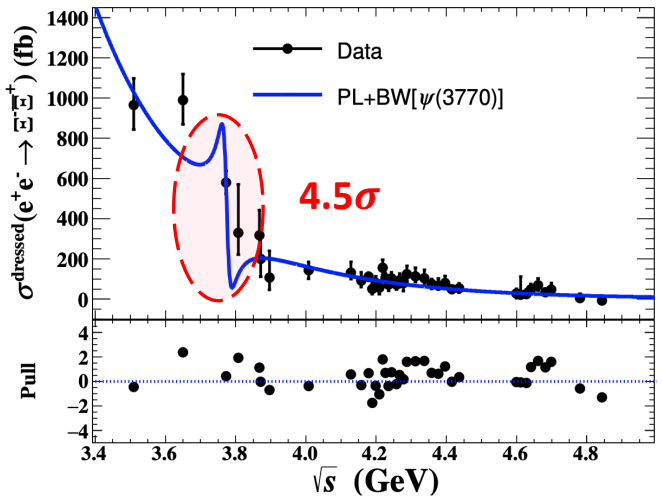
$e^+e^- \to H\bar{H}$ @ $\sqrt{s} = 3.5 - 4.9$ GeV

JHEP 11 (2023) 228
JHEP 05 (2024) 022
arXiv:2508.01359
PRL 124, 032002, (2020)
PRD 104, L091104 (2021)
PRD 111, L051502 (2025)

- First study of hyperon pair production, search for charmonium(-like) resonance







- Two evidences: $\psi(3770) \to \Lambda\bar{\Lambda}$ and $\Xi^-\bar{\Xi}^+$

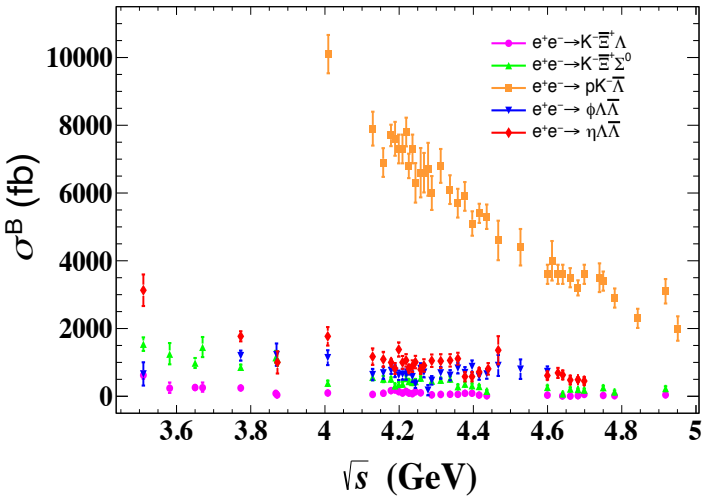
  $\mathcal{B}[\psi(3770) \to \Lambda\bar{\Lambda}] = 2.4^{+15.0}_{-1.9} \times 10^{-5}$ & $14.4^{+2.7}_{-14.0} \times 10^{-5}$

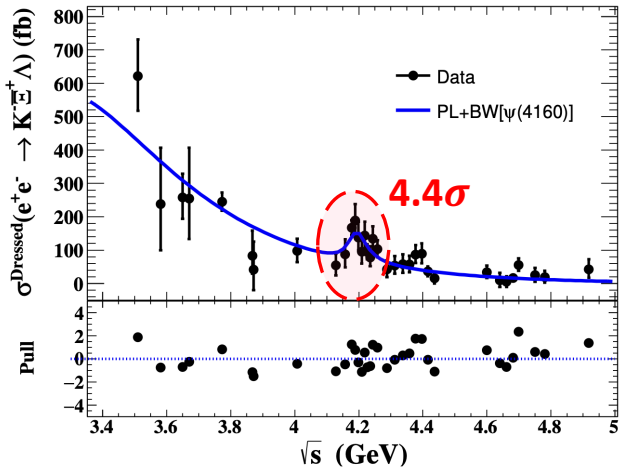
  $\mathcal{B}[\psi(3770) \to \Xi^-\bar{\Xi}^+] = (1.36 \pm 0.35) \times 10^{-4}$

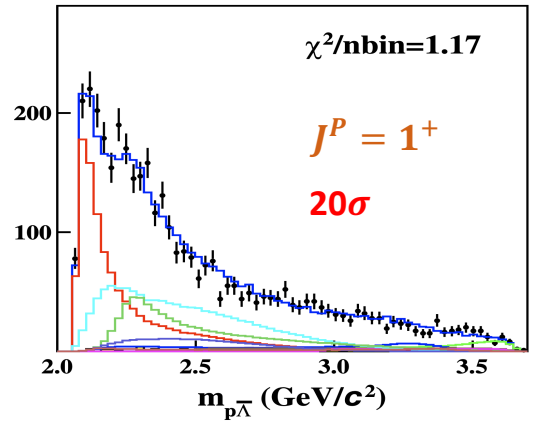
- No significance for other charmonium(-like) states
- Upper limits on $\Gamma_{ee}\mathcal{B}$ for other resonance assumptions are provided
- More measurements are ongoing

Three-body decay @ $\sqrt{s} = 3.5 - 4.9$ GeV

- **First study of hyperon final states production, hyperon spectrum, search for Charmonium(-like) states**

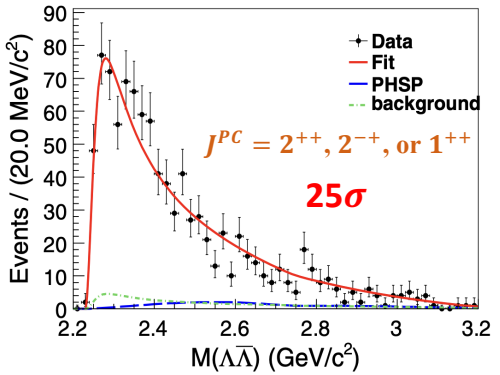


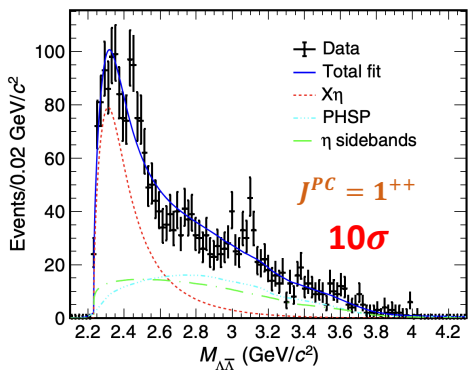




JHEP12(2023)027
JHEP07(2024)258
PRD104(2021)052006
PRD107(2023)112001
PRL131(2023)151901

$M = (2086^{+4}_{-2} \pm 9)$ MeV/c^2
$\Gamma = (56^{+4}_{-3} \pm 25)$ MeV



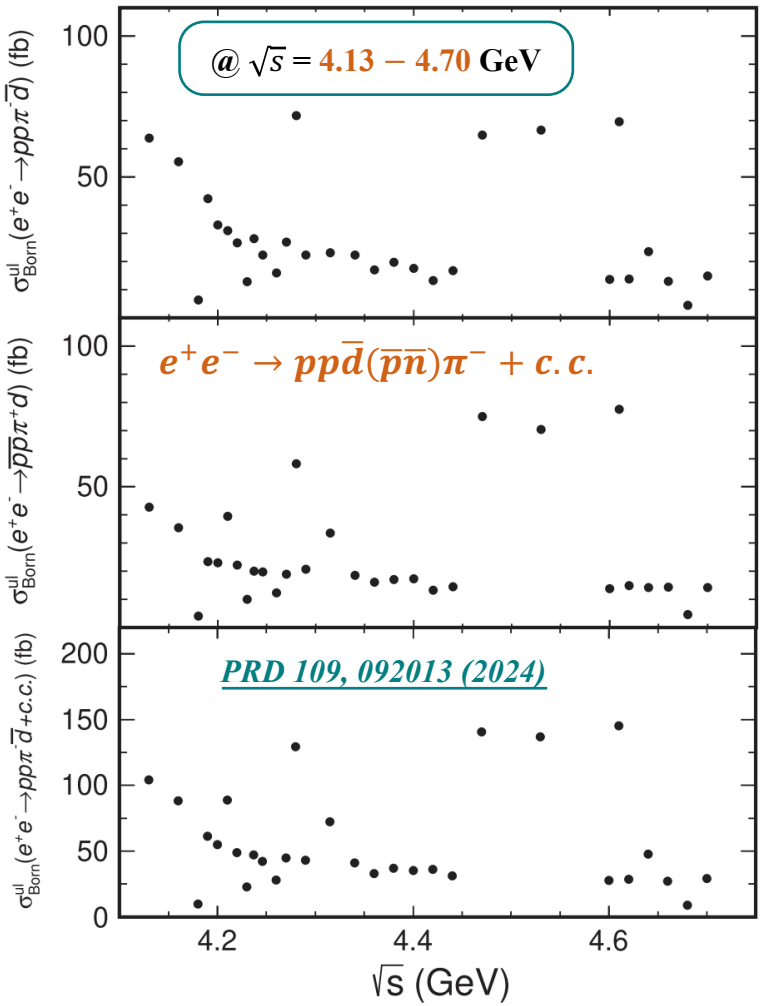


- **One evidence: $\mathcal{B}[\psi(4160) \to K^-\bar{\Xi}^+\Lambda] = (4.4 \pm 2.0)\times10^{-6}$**
- **No significance for other charmonium(-like) states**
- **Observations of near $\Lambda\bar{\Lambda}$ and $p\bar{\Lambda}$ enhancements**
- **More measurements are ongoing**

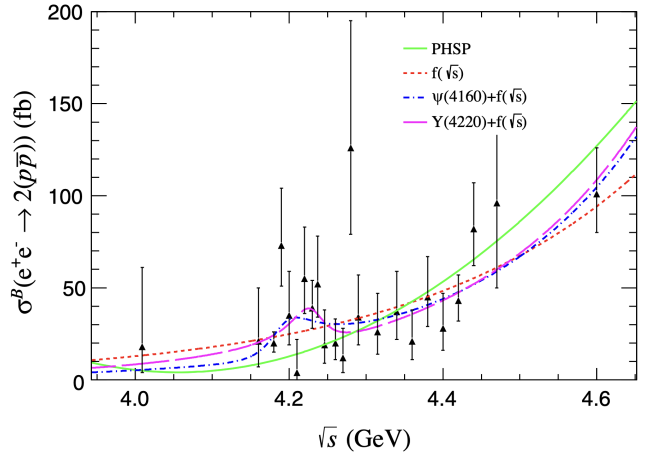
$M = (2262 \pm 4 \pm 28)$ MeV/c^2
$\Gamma = (72 \pm 5 \pm 43)$ MeV

$M = (2356 \pm 7 \pm 15)$ MeV/c^2
$\Gamma = (304 \pm 28 \pm 54)$ MeV

Other multi-body processes



- No significant (anti-)deuteron signal is observed.

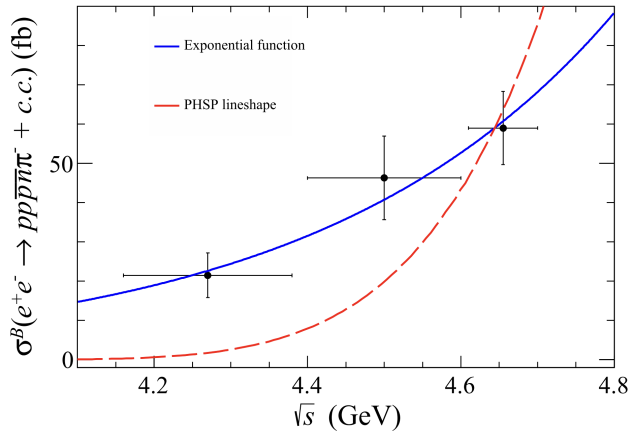


@ $\sqrt{s}$ = 4.0 – 4.6 GeV

$e^+e^- \to pp\bar{p}\bar{p}$

PRD 103, 052003 (2021)

- No significance for $Y(4220)/\psi(4160)$ assumption.
- Hexaquark/di-baryon state is searched.



@ $\sqrt{s}$ = 4.16 – 4.70 GeV

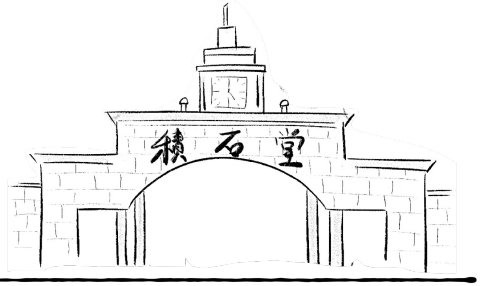
$e^+e^- \to pp\bar{p}\bar{n}\pi^- + c.c.$

CPC 47, 043001 (2023)

- $e^+e^- \to pp\bar{p}\bar{n}\pi^- + c.c.$ is observed for the first time (11σ).
- No significant deuteron, hexaquark, di-baryon, etc. are observed.

Outline

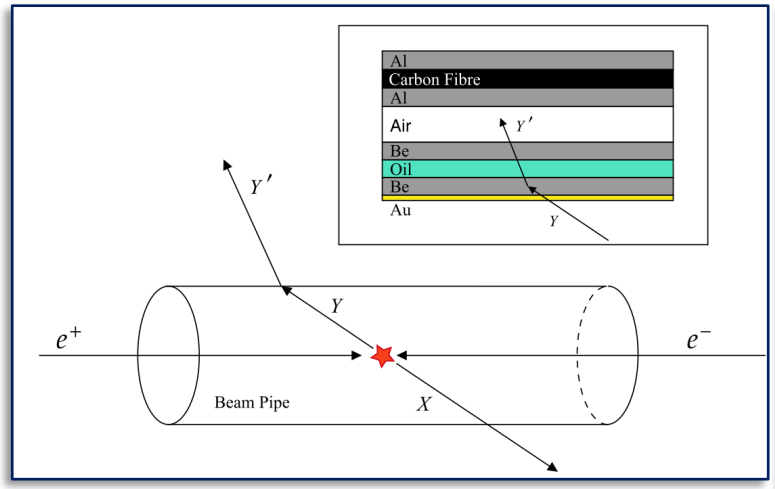
- Introduction
- Hyperon polarization & CPV
- Hyperon pair production
- **Hyperon nucleon interaction**
- Conclusion & Outlook

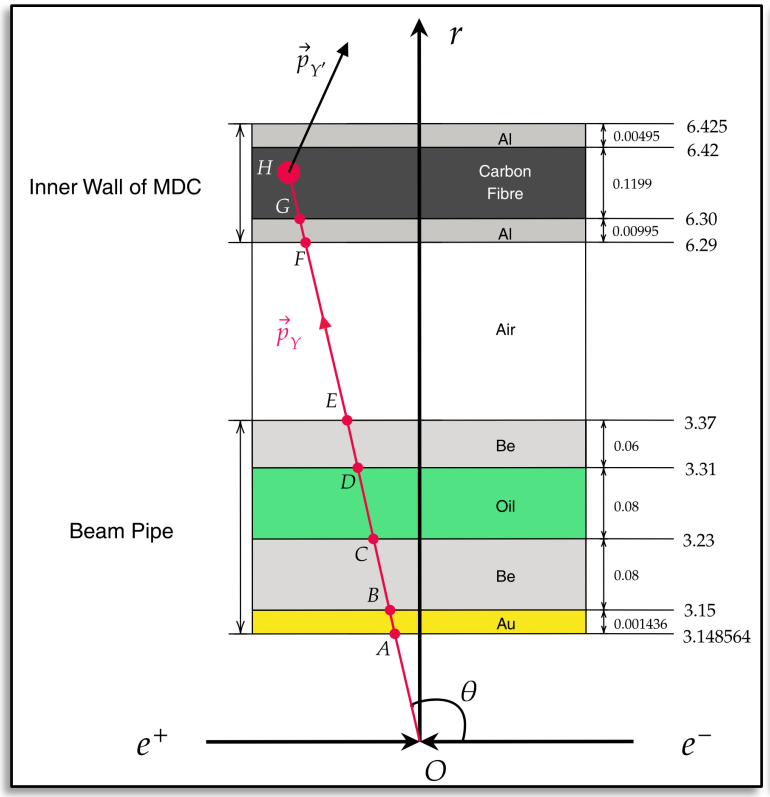


Hyperon nucleon interaction

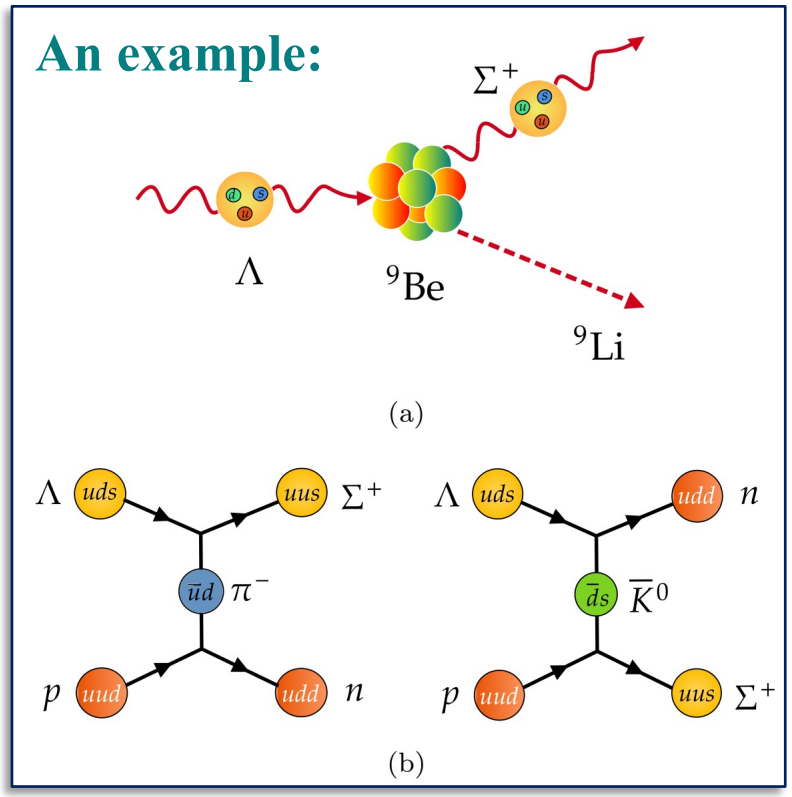
- YN interaction: understanding "hyperon puzzle" of neutron stars, strong interaction, original of nuclear force, probe of nuclear structure.
- Experimental study is quite scarce, even worse for $\bar{Y}N$ scattering.

PRL127(2021) 012003
CPC48 (2024) 073003





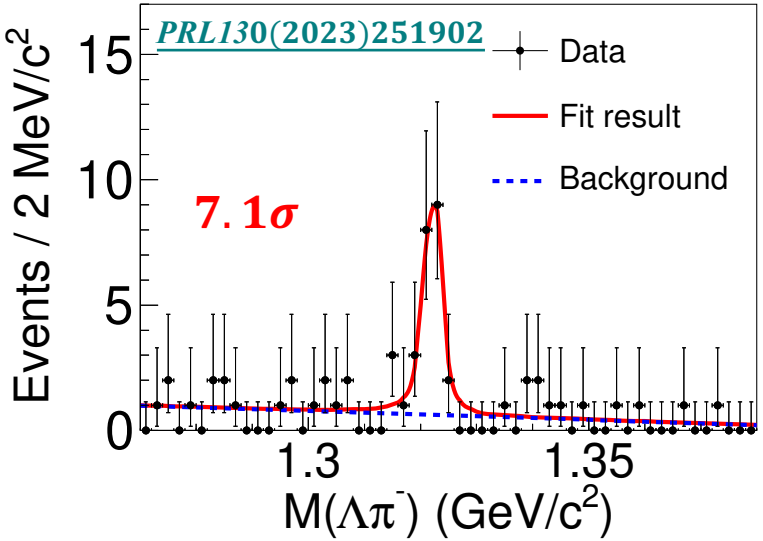
An example:

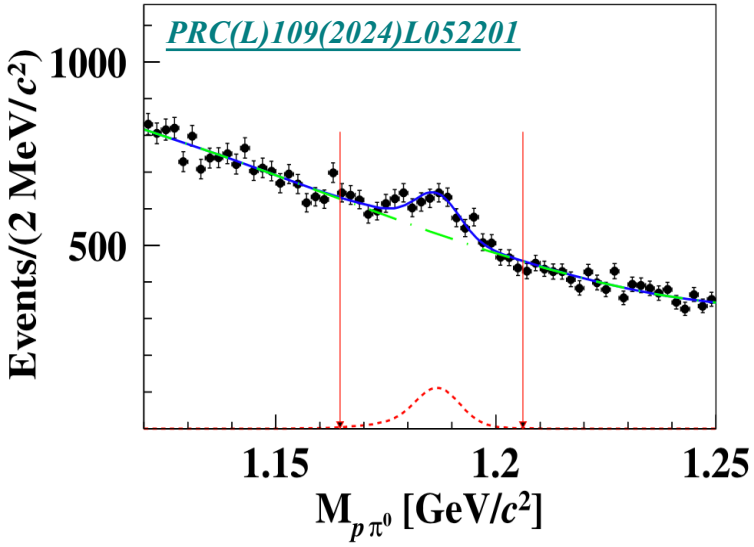


Material of the beam pipe: Gold (Au), Beryllium (Be), and Oil (^{12}C:^{1}H= 1:2.13), etc.

$\Xi^0 + n \to \Xi^- + p$ & $\Lambda + {}^9\mathrm{Be} \to \Sigma^+ + n$

- First study for $\Xi^0 n$ and ΛN inelastic scattering in $J/\psi \to \Xi^0\bar{\Xi}^0$ and $\Lambda\bar{\Lambda}$





- $\Xi^0 n \to \Xi^- p$ and $\Lambda {}^9\mathrm{Be} \to \Sigma^+ n$ are observed firstly, total inelastic cross sections are measured, results are consistent with theoretical prediction

$$\sigma(\Xi^0 n \to \Xi^- p) = (7.4 \pm 1.8(\mathrm{stat.}) \pm 1.5(\mathrm{syst.}))\ \mathrm{mb}$$

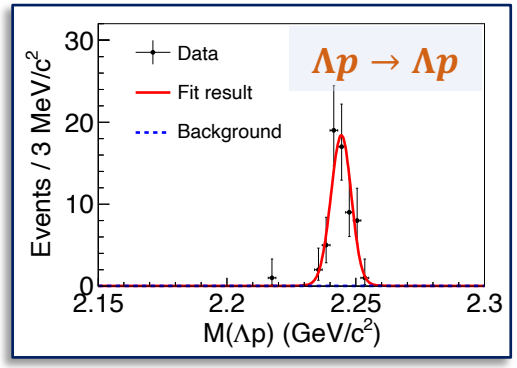
$$\sigma(\Xi^0 + {}^9\mathrm{Be} \to \Xi^- + p + {}^8\mathrm{Be}) = (22.1 \pm 5.3(\mathrm{stat.}) \pm 4.5(\mathrm{syst.}))\ \mathrm{mb}$$

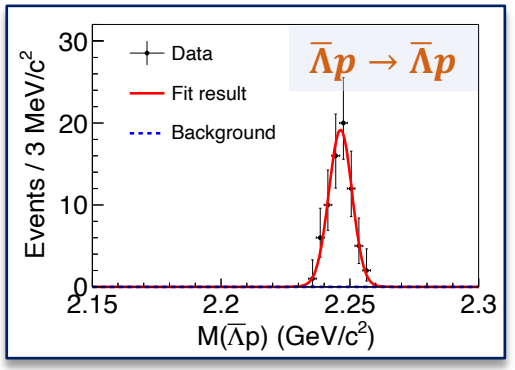
$$\sigma(\Lambda + {}^9\mathrm{Be} \to \Sigma^+ + X) = 37.3 \pm 4.7(\mathrm{stat.}) \pm 3.5(\mathrm{syst.})\mathrm{mb}$$

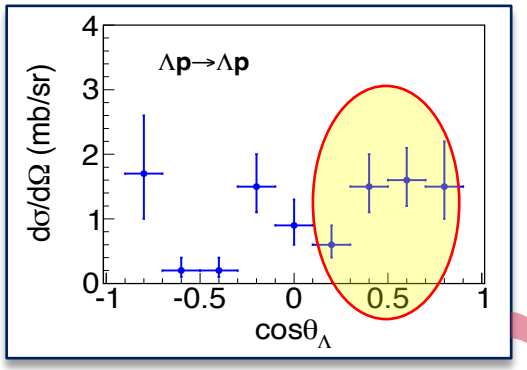
$\Lambda + p \to \Lambda + p$ & $\bar{\Lambda} + p \to \bar{\Lambda} + p$

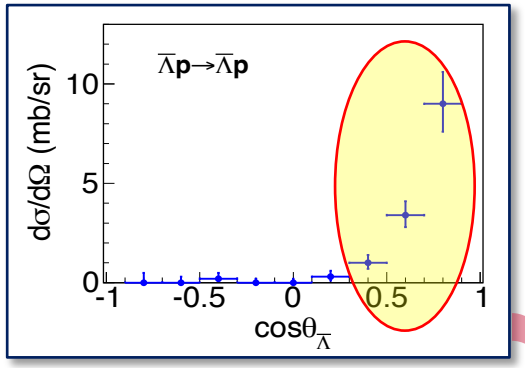
- First study for (anti-)hyperon and nucleon in $J/\psi \to \Lambda\bar{\Lambda}$

PRL132(2024)231902





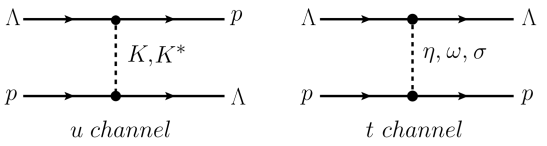


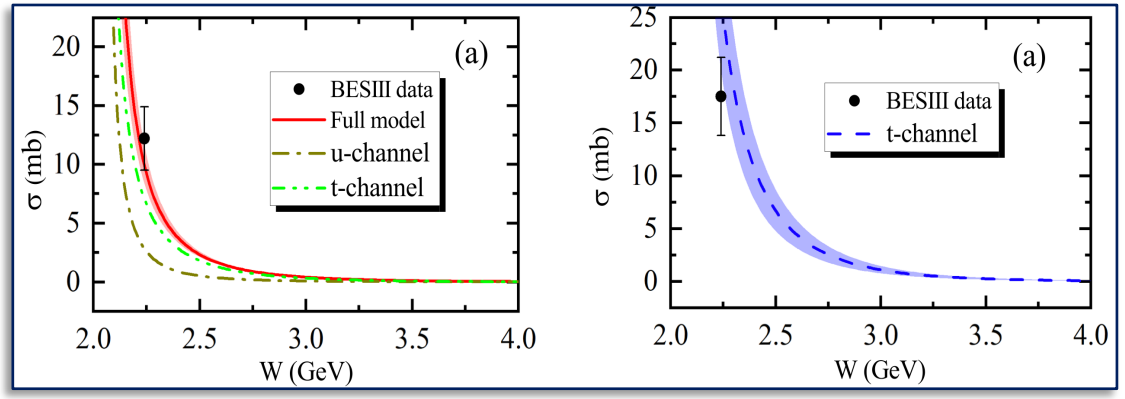


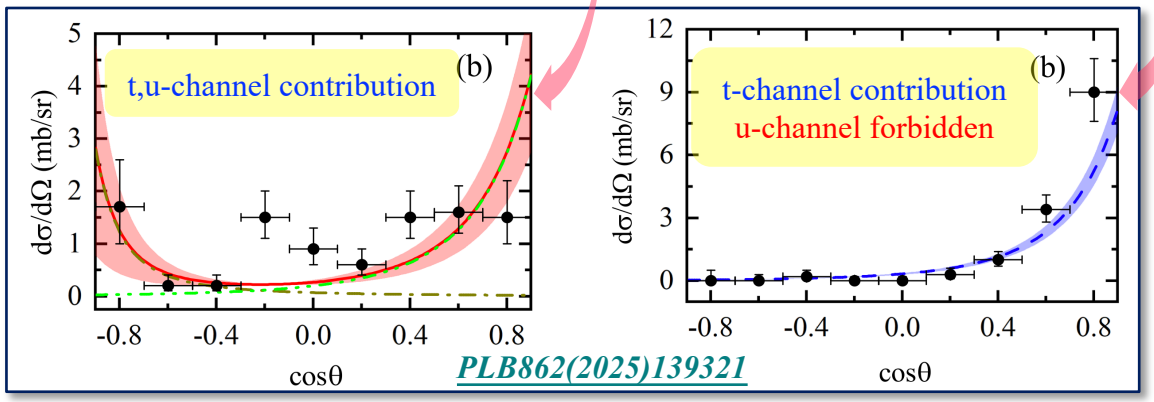
- Total elastic cross sections in $-0.9 \leq \cos\theta_\Lambda \leq 0.9$ are measured

$\sigma(\Lambda p \to \Lambda p) = (12.2 \pm 1.6(\text{stat.}) \pm 1.1(\text{syst.}))$ mb

$\sigma(\bar{\Lambda} p \to \bar{\Lambda} p) = (17.5 \pm 2.1(\text{stat.}) \pm 1.6(\text{syst.}))$ mb



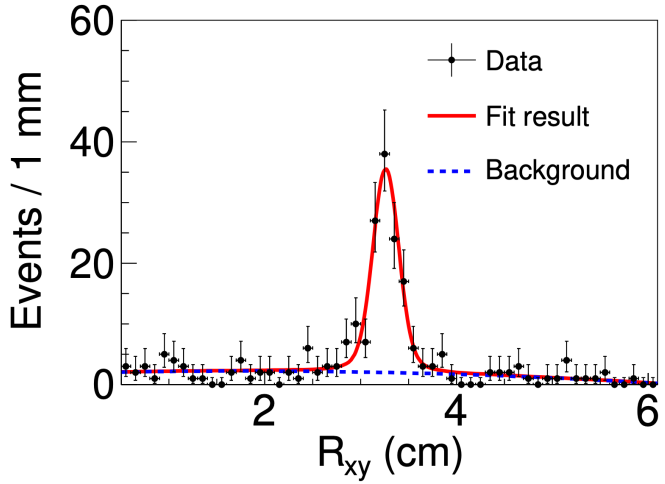


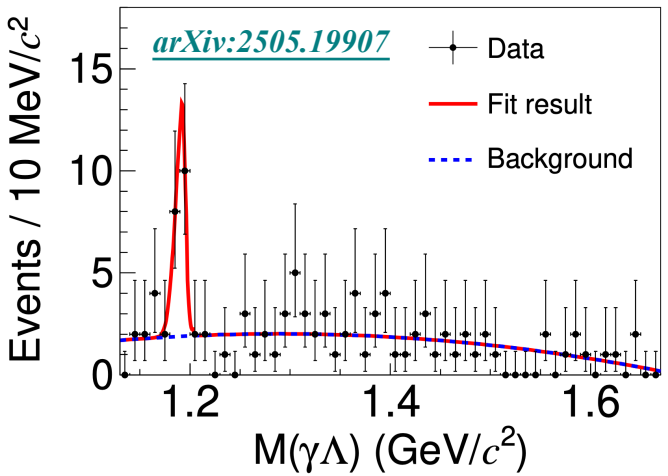


PLB862(2025)139321

$\Sigma^+ + n \to \Lambda + p$ & $\Sigma^+ + n \to \Sigma^0 + p$

- First study for Σ^+ hyperon and nucleon in $J/\psi \to \Sigma^+\bar{\Sigma}^-$

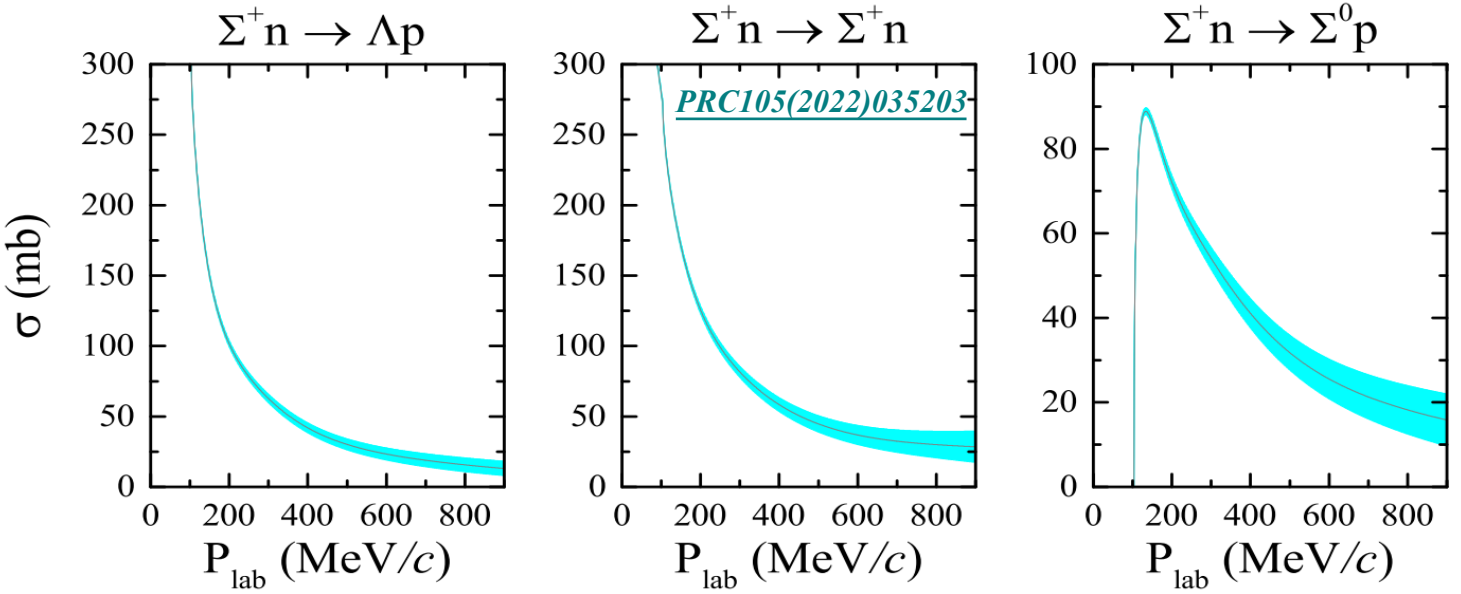




- Total inelastic cross sections are measured :

$$\sigma(\Sigma^+ n \to \Lambda p) = \left(15.1 \pm 4.0(\text{stat.}) \pm 2.4(\text{sys.})\right) \text{mb}$$
$$\sigma\left(\Sigma^+ n \to \Sigma^0 p\right) = \left(9.9 \pm 3.2(\text{stat.}) \pm 2.3(\text{sys.})\right) \text{mb}$$

- The results are in good agreement with theoretical predictions.



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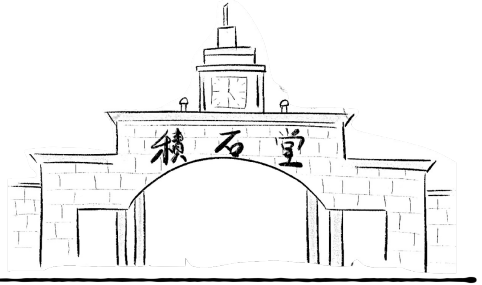

Conclusion & Outlook

- **Many studies for hyperon physics in e^+e^- collider achieved**
  - ✓ **Hyperon polarization observation**
  - ✓ **CPV in hyperon: O(~10^{-3})[SM~ 10^{-4}]**
  - ✓ **More two(three)-body hyperon pair production**
  - ✓ **Evidences of $\psi(3770) \to \Lambda\bar{\Lambda}/\Xi^-\bar{\Xi}^+$ and $\psi(4160) \to K^-\bar{\Xi}^+\Lambda$**
  - ✓ **Hyperon nucleon interaction: $\Xi^0 n$, ΛN, etc.**
  - ✓ **…**
- **More new results are on the way**

Thanks for your attention!